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ABSTRACT

The strategy for giving educators a more solid and sophisticated indoctrination in the uses and possibilities of technology in education must aim at the reduction of the extreme points of view of the pertisans and opponents of technology. A. W. VanderMeer sees the prospective teacher as a professional with a thorough grasp, not only of every aspect of educational technology, but also of humanistic studies, behavioral sciences, and of the wide range of content to be taught within the discipline of the teacher's competence. The prospective teacher, in his training, should be creatively and self-consciously involved in a system of education which will establish in him those professional techniques and ways of study and operation that typify the manner in which applied social scientists apply their professions. (Author/GO)

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How Teachers and Administrators Can Be Given a Better Indoctrination on the Potentialities and Uses of Instructional Technology

by A. W. VanderMeer*

The question of how teachers and school administrators may be given a more solid and sophisticated indoctrination in the uses and possibilities of instructional technology presupposes that instructional technology can make a significant contribution to the achievement of the goals of the American system of education. Other papers in this series cite research and informed opinion which, in general, support this presupposition. The issue, of course, does not end here, for while there is little doubt that instructional technology is deservedly "here to stay" there are grave differences of opinion with respect to the dimensions of the contributions of this field. There are disagreements as to which educational goals it can help to achieve, and there are disagreements as to the extent to which instructional technology can make a quantitative difference in the achievement of these goals.

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It is necessary to recognise that extreme positions exist in the spectrum of opinions regarding instructional technology. There is the minority view that to introduce any amount of technology into education is to dehumanize it. A major cliche on university campuses is that students are reduced to numbers to be manipulated by computers, and this attitude is clearly a part of student unrest in secondary schools. Instructional television, computer-assisted and other machine instruction, and even motion pictures are included as targets of this cliche. The existential primacy given to feeling as opposed to reason is easily extrapolated to justify an antigonism toward technology on the grounds that it is basically rational and scientistic rather than affective and emotional. Then there are the devotees of the printed and spoken word who, since they cannot view non-verbal media as occupying any but a subordinate position on the hierarchy of intellectuality, resist technology on the grounds that it may divert the better minds from the necessarily arduous task of achieving a level of literacy that is commensurate with their aspirations and abilities. Even those who may agree with McLuhan that the linearity of verbal communication is at least somewhat anachronistic seem to emphasize the relevance of non-verbal media to the needs and desires for self-expression and self-fulfillment rather than to presentational and instructional applications.

On the other hand, there are the highly partisan advocates of instructional technology. James D. Finn, writing in "Planning for Effective Utilization of Technology in Education" [1] points out that extravagant claims have been made for the impact of technology on education for more than half a century, and documents this contention with a series of quotations beginning with Thomas Edison who is supposed to have stated for the New York Dramatic Mirror's issue of July 13, 1913, "Books will soon be obsolete in the schools. Scholars will soon be instructed through the eye. It is possible to teach every branch of juman knowledge with a motion picture. Our school system will be completely changed in ten years.". More recently, E.B.Kurtz [2], writing of instructional television, stated "....this new instrumentality ....bids fair to become the most potent agency for universal education ever conceived. Similarly extravagant claims could be cited for teaching machines and computer-assisted instruction.

A more analytical view of the potential of instructional technology assumes that it can make different levels of contributions to the achievement of different goals of education or

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[1] Finn, James D., Planning for Effective Utilization of Technology in Education, Designing Education for the Future: An Eight State Project, Denver, Colorado. August 1968. p. 37-48.

[2] Kurtz, E.B., Pioneering in Educational Television. Iowa City, State University of Iowa, 1959, p. 70-72.

that there are some kinds of learning to which instructional technology can be applied with salutary effects while there are others to which it has limited or zero applicability. For example, Harry Broudy[1] in a piece following that of Professor Finn's, writes "For this type of explicit instruction (imparting knowledge - either of facts or principles - for rote learning or for problem-solving) the traditional teacher is needed no more than covered wagons are needed for cross country transportation. If they <u>are</u> needed, it is for the type of teaching encounters that we noted in Socrates' teaching of virtue, or value education. This is the tacit, personalized phase of instruction. ....The humanities, aesthetic education, molar problem solving, interdisciplinary explorations are a few of the areas in which encounter-teaching rather than didactic teaching is stressed. The human encounter, Buber's I-Thou relation, the imaginative sympathy entailed by such encounters - these will be the characteristics of their (the teacher's) styles. Such encounters cannot take place en masse."

Clearly, the whole strategy for giving teachers and school administrators a more solid and sophisticated indoctrination in the uses and possibilities of technology in education must aim at the reduction of the extreme points of view of the more radical partisans of and opponents of technology.

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[2] op. cit. p. 109.

The analytical approach suggested by Broudy seems to offer the greatest promise as a meeting ground for the reconciliation of the extremes.

One additional prefatory point must be made in advance of a consideration of specific tactics for the successful introduction of an indoctrination in technology into the pre-service and in-service education of teachers and administrators; namely, that we have to depend to an inordinate degree on what appears to be reasonable in judging the effectiveness of educational systems (and, indeed, of the teaching component of these systems) rather than on quantitative data. We have to recognize that there is little agreement as to valid criteria of teaching success or, by extension, the success of teacher education programs. Actually, the issue is in doubt as to whether we can hope to produce in the prospective or practicing teacher those behaviors that are required if he is to accept the worth of instructional technology and to use it effectively.

Dr. Donald M. Medley, [1] of the Educational Testing Service states "The direction and amount of change that should be produced in each teacher would tend to be unique to him, and few or no generalization can be made about what constitutes 'improvement' in teacher behavior - at least in our present state of ignorance.

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[1] Medley, Donald M. "The Research Context and the Goals of Teacher Education" Princeton, New Jersey:Educational Testing Service. Unpublished paper.

"Perhaps the picture I have painted is too dark. Maybe there are not quite as many different types of teacher behavior all of which are equally effective, as I have imagined. But I am sure that this picture, pessimistic as it is, is closer to the truth than the simplistic model we have used in the past, the model which assumes that for any given definition of effectiveness there is one behavior pattern which is most effective for all teachers. Research has certainly not been able to identify any such pattern, and it has certainly tried."

Medley goes on to suggest the following characteristics of the model teacher education program which, he says, will provide the teacher with four things, " (1) an experimental attitude - a willingness to examine, evaluate, and modify his own teaching behavior throughout his career, (2) theoretical knowledge - familiarity with all that past experience and research has discovered which might be useful to him, (3) technical skill - control over the methods, techniques, and media of instruction (including his own behavior), so that he can implement the theoretical knowledge he possesses, (4) feedback techniques - ability to use objective methods for analyzing teacher behavior and assessing its outcomes so that he can learn from his experiences."

Clearly, if we follow Medley's anti-simplistic theses, we are compelled ourselves to apply technology to the process of education of teachers and administrators; we must think and

941

plan in terms of behavioral objectives which can be attained through a variety of paths according to the characteristics of those being educated. We must consider, too, long and short range plans for the preparation of personnel for the teaching professions. In the short range, attention is focused on producing an educator who is able to adapt to the current milieu while at the same time serving as an agent of change looking toward the schools of the future. In the long range, we must begin now to prepare personnel for an entirely new table of organization for the schools - one which will require professionals and support personnel that are now only dimly thought of. In the case of short range plan it is opined that the responsibility of teacher education is to produce teachers and administrators who (1) know the uses and the limits of the uses of technology, (2) are able to exploit technology efficiently in the achievement of legitimate and agreed educational goals, and (3) take pride in applying technology effectively to those purposes for which it is appropriate, and (4) are secure and satisfied in assuming the roles that are appropriate when technology is thoroughly exploited.

With regard to the long range plan it is assumed that the scope of teacher education must accommodate personnel other than teachers and administrators who will need to be prepared as a result of the application of technology to

education as well as for the utilization of technology. For example, Broudy [1] envisions three types of personnel for schools distinct from the teacher: namely, (1) instructional technicians whose responsibility would be to assign pupils to instructional programs and to reassign them as the demands of individualized instruction dictate, (2) instructional programers whose job it would be to write the programs that are fed into the system and (3) instructional managers whose responsibility would be to turn the instructional packages into schedules to be implemented by instructional technicians, and to exercise general supervision over all instruction. One can recognize the third of Broudy's non-teaching instructional personnel as closely similar to administrators, since, broadly speaking, it might be said that the function of school administrators is to make it possible for teachers (and other instructional personnel) to operate efficiently in the use of instructional technology.

In a complementary vein, Ward and Young [2] predict that "Technology will increasingly supplement but not replace the classroom teacher. So the present functions of the teacher will be performed more effectively as a result of the technological advances.

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[1] op. cit. p. 108, 109.

[2] Ibid. p.312.

"A growing array of learning materials, media, and instructional strategies will be available. The teacher must be able to make rational decisions about their selection and sequencing.

"The teacher's role in the future is likely to feature: (1) a decreased emphasis upon information-giving; (2) increased attention to the development of higher order cognitive outcomes; (3) increased attention to the development of constructive affective outcomes; and (4) the integration of both cognitive and affective processes for the improvement of learner outcomes.

"Accelerating change, such as the information explosion and the rate of technological advances, demands a personal capacity on the part of teachers for thoughtful and systematic change.

"One of the major, relatively untapped resources in education is the self-instructional capacity of the learner. An increased function of the teacher role needs to be the provision of opportunities for students to learn how to learn.

"A realistic perception of one's self, and of one's interpersonal relationships, is crucial for highly effective teaching."

Several alternative models of teacher education programs can be envisioned to produce professionals who will have the competencies demanded by tomorrow's technologically-oriented educational system. What might be labeled the didactic model of teacher education presently is most commonly used. This

model assumes that there is a body of content which can be mastered in more or less formal course work and then applied in classroom situations, first under supervision and later independently. It is necessary that the prospective teacher develop a high level of competency in (1) creating and/or selecting measures that describe relevant characteristics of children, (2) retrieving information about children, and (3) using information to diagnose and prescribe instructional procedures and strategies for the children. This clearly calls for a knowledge of a range of subject matter and of presentation modes as well as of characteristics of media; a thorough knowledge of a wide array and range of teaching and learning strategies; and the ability to relate both of the foregoing to such characteristics of learners such as maturity - motivation - sensory preferences - etc. While it must be readily conceded that not all of the content for this formal didactic instructional model for teacher education exists; it is clear that at least these three components will be represented:

1. Humanistic studies: The teacher will need to understand a range of fundamental philosophical positions (perhaps realism, idealism, pragmatism, existentialism) and what characteristics of curriculum and method are consistent with each. What objectives are valid under the alternative philosophical positions?

945

2. Behavioral Sciences: Both sociology and psychology as well as, to a lesser extent political science and economics: The teacher will need to know the range of human developmental patterns, learning styles, motivations and value patterns, social structures and organization, etc. Also, of course, it is through the methods of the behavioral sciences that media and technological devices themselves are studied in terms of their own intrinsic characteristics and of the relationship between these characteristics and the characteristics of educational objectives.

3. Teaching field or discipline: A thorough knowledge of a wide range of content to be taught within the discipline of the teacher's competence. Under the present school organization, it is axiomatic that the teacher must have both breadth and depth of preparation in the subject or subjects that he will teach. This axiom is rooted in the assumption that the teacher's role is largely that of a dispenser of knowledge rather than as a manager[1] of a learning environment. While the latter is the only role that is consistent with the school of the future in the view of some people, the former is consistent with Broudy's dichotomy between explicit and tacit instruction and, of course, with his projected professional instructional manager. There is, however, no essential conflict here, although it will be necessary to modify drastically the

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[1] Used here in a more general sense than of the specific professional person identified by Broudy, op. cit. page 108-109.

technique whereby the content to be taught is mediated to the prospective teacher if he is to be fully equipped to use the new technology. Robert Glaser [1] describes as untenable the present assumption that "the way in which a discipline structures its knowledge provides the best structure for transmitting it to students." He goes on to observe that courses are too frequently organized in a way that satisfies the epistemological purposes of the body of knowledge involved, which organization is sometimes theoretical and logical and sometimes chronological and fortuitous. He favors rather than the exclusive attention to the requirements of the structure of the discipline at least equal attention to the requirements for transmitting the discipline to the student. Finally, he points out that a task for psychological research is to identify appropriate learning structures that can be incorporated into the epistemological structure of the knowledge in order to produce a more ideal learning process.

The prospective teacher must know his subject in three dimensions: (1) he must have more than a rudimentary grasp of its structure, its vocabulary, and its methods; (2) he must have sufficient breadth and depth of knowledge to be able to suggest viable alternative subject matter content that is

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[1] Glaser, Robert. "Ten Untenable Assumptions of College Instruction." Educational Record, Spring 1968. p. 158.

appropriate for individual learners who differ from one another in such crucial variables as aptitude, maturity, motivation, and learning style; and (3) he must have a sufficient range of knowledge to work within the present range of curriculum offerings represented in the schools. As a general criterion, the prospective teacher should be able to read with understanding middle level journals in his discipline and in the literature of the teaching of his field. This latter includes the experimental literature on teaching and learning in his field, and the various curriculum proposals in his field.

To provide the beginning teacher with the kind of education described in the previous paragraph is a large order; one that is not likely to be filled by the present common array of discipline structured courses; rather it may be essential that at least a portion of the education of the prospective teacher in the content that he will be expected to teach should consciously and by design incorporate (1) a consideration of analysis of the knowledge into units that can provide building blocks by which the learner goes through an instructional sequence, and (2) the media and technology whereby these building blocks can be conveyed to the student. Such instruction would partake of a number of forms: (1) The college teacher would call attention to the way that he has organized subject for presentation, justifying this organization by consideration of alternative methods. (2) By the same token, alternative presentation modes would

be considered incidentally with the presentation of subject matter. (3) The learner would be encouraged to introspectively and self-consciously examine the process whereby he himself is learning the subject matter and to verbalize for examination by his instructor and his peers the results of his self-examination.

The kind of "professionalization" of subject matter proposed in the preceding paragraph would not necessarily encompass the entire range of content learned in the course of the prospective teacher's education. More than likely it would be best placed <u>following</u> the mastery of the basic structure and vocabulary of the discipline and <u>prior to</u> a level of higher specialization within the discipline. Most of the latter would presumably occur at the post baccalaureate level. "Professionalized subject matter" in the teaching field would, then, be the intermediate level of collegiate training, and would coincide with studies in the humanities and behavioral sciences as applied to education and as indicated in previous paragraphs. Correlation and coordination should, in this didactic model, occur at all levels between the behavioral sciences (including Education) and humanistic studies on the one hand, and studies of the teaching field disciplines on the other. While the teacher candidate is learning the structure of his teaching field he should also be learning the structure of, at least on the rudimentary level, philosophy, psychology and sociology. As he is learning the application of these

disciplines to education he would be assisted in making connection across to the professionalized subject matter component of his education in his teaching field or fields.

In the model of teacher education described thus far emphasis has been given to shaping the environmental influences of the teacher education program in the interests of developing skills in the use of media and of creating a style of attacking the job of teaching in a way that is compatible with the fuller introduction of instructional technology into the school system. This is, perhaps, a verbose way of saying that the teacher education program should exploit the imitative potential of prospective teachers. One should, incidentally, reject vigorously the platitude that "teachers tend to teach as they have been taught." If this were true it would deny that teaching is a rational process.

The following points extend and make more explicit what has been implied in the didactic model of teacher education presented up to now; namely, that the program should exemplify the widest and best-reasoned use of instructional technology:

1. Obviously a wide variety of media should be used in the presentational aspects of teacher education, and these should be systematically evaluated by the instructor and the students as an integral part of many if not most of the courses required of the teacher candidate.

2. A wide variety of media should be assigned as major sources for the prospective teacher. Instead of confining outside assignments to typical print material, the student should frequently be directed to recordings, filmstrips, films, tapes, and the like. Computers should be used for review, brush-up, and direct instruction by students. Assigned projects should require the prospective teacher to use a wide range of materials which, of course, presupposes a learning resources center that far exceeds in variety of resources, the conventional library. Instead of assigning reports to be submitted always as papers, students should be encouraged to report the results of their independent study in the form of film, tape, filmstrip, script, or the like.

3. Generous use of media in feed-back between instructor and student and vice versa should be characteristic of the teacher education program. A tape recorder could be used, for example, as a means whereby the instructor can communicate his criticisms of student performance (be it theme-writing or lesson presentation) to the teacher. Video-tape and audio tape should be used for guided and independent self-analysis of performance in micro teaching and in interneships.

4. A major activity of teacher education faculty should be research and development in instructional technology, and undergraduate as well as graduate students should be involved in these R & D processes. Such student involvement would, of course, pertain to individual projects of modest size as well as mission-oriented research and development. For example, John Pfeiffer [1] suggests an educational application of the Delphi method developed by Olaf Helmer and his colleagues in the early fifties at the Rand Corporation. The general idea of this method is to prepare successive rounds of questions designed to elicit progressively more carefully considered group opinions. Pfeiffer reports the results of a 1965 pilot experiment in which three groups of educators who had recently participated in various discussions of innovations filled out the Delphi questionnaire and produced a list of 93 proposed reforms, together with estimates of what the Federal Government would have to spend during a five-year period to carry out each reform independently. The result was a consensus regarding

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[1] Pfeiffer, John. New Look At Education. Poughkeepsie, New York: Odessey Press, 1968. p. 152-156.

the allocation of funds among various proposals. It is easy to see how such a technique involving students and faculty members could produce insights and understandings in the realm of instructional technology.

What is, in essence, proposed in the foregoing paragraphs relative to teacher edication in the wise use of instructional technology is the thorough immersion of the prospective teacher in a creative and self-conscious involvement in a system of education which, though it pertains to his own immediate goals, will bid fair to establish in him those professional techniques and ways of study and operation that typify the manner in which applied social scientists apply their professions. The focus is on active, thoughtful, self-analytical goal-related studies rather than on the plain acquisition of knowledge and skills. A fuller exposition of this concept has been presented by Mars [1] in a publication for the American Association of Colleges for Teacher Education.

Up to this point, no mention has been made of instructional technology as a subject to be studied directly.

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[1] Mars, Walter J. Professional Teacher Education. Washington, D.C.:AACTE, 1201 16th St. N.W., 1968.

In the didactic model, formal study of this subject is definitely indicated. It is odd, is it not, that the curriculum of general education allocates so much time to the study of verbal language and so very little to the study of other forms of communication or even to the study of communication itself? It seems clear that it is esential that the teacher and the administrator have a high level of sophistication in communication. In the didactic model of teacher education this would come, presumably, as a result of a course taught well and within the environmental context previously described. The content of the course would include communication theory and models, analysis or existing channels and media, and practice in creating or producing as well as utilizing various media.

An alternative model of teacher education that is widely talked about but little used might be labeled as the functional model. Such a model is proposed by Bush [1]. In essence such a model proposes that at least the professional part of teacher education be geared to and grow out of the problems and observations encountered by teacher candidates in direct confrontation with students in public schools.

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[1] Bush, Robert. The Real World of the Beginning Teacher. (NCTEPS, 1201 16th Street, N.W., Washington, D.C.) p. 12-14. It should be noted that this model could also serve as a semi-didactic model.

954

The difference between didactic and functional models may be seen as largely one of tactics; agreement as to the skills, knowledges and attitudes sought would probably cover the major portion of the teacher education curriculum. In one study comparing these approaches, Torkelson [1] compared the effectiveness of a formal course in instructional materials with two approaches which integrated what was presumed to be the same objectives and content into practicum and methods in teaching. In general, his findings slightly favored the didactic approach; however, the functional approach was plagued with logistical problems and those who employed it had had the majority of their experience in more didactic approaches, so it would be wise to follow Torkelson's advice to avoid the temptation to generalize too far from his data.

Up to this point, pre-service training has been implicit in this discussion. Most of what has been written applies with equal force to in-service training. It is not to be expected that a pre-service education, however excellent, will last a lifetime. The pre-service preparation of the teacher must be followed by a continuing program of in-service education. It matters little whether these in-service activities are conducted by the universities, by school districts, by professional societies, or by a combination of these.

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[1] Torkelson, G.M. An Experimental Study of Patterns for Improving the Preparation of Pre-Service Teachers in the Use of Audiovisual Materials and of Effects on Pupils. Title VII Project # 079, NDEA 1958. Grant # 7-48-0720-034. University Park, Pennsylvania. College of Education, The Pennsylvania State University. March 1965.

The essential thing is that they be conducted and conducted well. Not only must education follow current graduates into the field, but also the existing instructional personnel presently manning the schools must not be neglected. In Pennsylvania, for example, the average number of years of service of elementary teachers in 1967 - 68 was nearly 15 [1] while the average years of service of secondary teachers was nearly 12. It should not be inferred that these teachers had been completely innocent of in-service training during their years of service, but it should likewise not be assumed that their in-service training necessarily prepares them for the wisest and most fruitful participation in the applications of instructional technology.

What is true of teachers - that one can infer some need for in-service education from their average years of service - is even more dramatically true of administrators and supervisors. The average years of service of district superintendents was nearly 29 years. This was likewise true for supervising principals. Supervisors of elementary education and of secondary education averaged 23 and 26 years of service respectively, while county superintendents averaged a tremendous 35 years of service.

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[1] The Pennsylvania Department of Public Instruction: The Calculator, Vol. 10, No. 1. September 1968.

956

The content of in-service education in instructional technology does not differ much in kind from that suggested for in-service education; rather, it differs in level and in qualitative aspects. What the experienced teacher and administrator may lack in youthful energy and disposition toward change, he frequently makes up in insightful experience and dedication to quality education. Of particular importance, however, is the use of technology itself in bringing in-service education to the field. Modern extension work is pioneering the use of video- and audio-tapes, conference telephone hook-ups, and other exploitations of instructional technology. Such advanced applications of technology are, unfortunately, in the minority.

An excellent example of the use of technology in in-service education to instruct not only in teaching content but in the applicability of technology itself is reported by Riedesel.[1] Elementary school teachers in service in Willaimsport, some 65 miles from the campus of the Pennsylvania State University were provided with access to CAI terminals in their home location. The response stations were connected with the computers at the University on a schedule which permitted the

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[1] Long, Samuel M., C.Alan Riedesel. Use of Computer Assisted Instruction for Mathematics In-Service Education of Elementary School Teachers, Center for Cooperative Research with Schools, College of Education, Pennsylvania State University, University Park, Pennsylvania. October 31, 1967.

teacher to study a professionalized course in modern mathematics at her convenience. Not only did the teachers learn modern mathematics but they had a fascinating experience in the application of technology to teaching. A project whereby a similar course is taken to remote schools in Appalachia in movable van is under consideration by the Appalachian Regional Educational Laboratory.

Brickell has pointed out the crucial role that the school administrator plays in educational change. Clearly the skills brought to instruction by well-trained teachers can largely be frustrated in administrative situations where fruitful innovation is discouraged and where the means of instructional reform are not made available. The principle of managing the environment to support desired learning is applicable likewise to the education of administrators in-service and pre-service in the implications of instructional technology.

It goes without saying that a comprehensive study of the present and potential impact of technology on instruction and on school organization should be a part of the curriculum for the administrator. In addition to this obvious fact, however, experience should be given the prospective administrator in the use of the computer in various administrative tasks - scheduling, personnel records for pupils and teachers,

958

accounting procedures, etc. By the same token, the applications of technology in educational planning should be taught to students of school administration in graduate programs and demonstrated to active administrators in the schools. If systems analysis concepts, procedures and tools are an important part of the administrators armamentum, he is very likely to behave in a sophisticated and supportive manner with regard to the application of technology in the instructional domain of the total school system.

It should be borne in mind that the school systems of the near future will require new types of administrative personnel. Graduate programs in educational administration should enhance the concept of differentiation of function by preparing administrative support personnel such as business managers, operation analysts, and instructional technologists.

One final element is required in connection with the indoctrination of teachers and administrators in the possibilities and use of instructional technology; namely, the preparation of professional education personnel themselves, that is, professors of education. By and large, the most neglected factor in Federal programs of support for education is that of the training of professors of education and their

support personnel. A recent promising development is the Triple T program whereby the training of teacher trainers is to be subsidized through the U.S.Office of Education. Unfortunately, little emphasis is provided in the guidelines with respect to instructional technology. College professors, including professors of education are generally highly individualistic and highly verbal. Graduate schools of education need to turn their attention to the preparation of a new breed of instruction-oriented, technologically sophisticated professors of education. Research in media and instructional techniques should be central to the preparation of this group of professionals. Their model should not be the lecturer droning away at his podium but that of the manager of instruction who uses a wide range of media and techniques for the development of skills in his students, and that of the creative and scholarly researcher who exploits the discipleship concept of graduate education as he makes contributions to knowledge in the areas of instruction and technology.

October 1968